WHAT IS CLAIMED IS:

1. An integrated optical device comprising:

a vertically lasing semiconductor optical amplifier (VLSOA) comprising:

an amplifier input;

an amplifier output;

a semiconductor active region;

an amplifying path connecting the amplifier input to the amplifier output and traversing the semiconductor active region; and

a vertical laser cavity including the semiconductor active region; and

an optical element, wherein a portion of the VLSOA and a portion of the optical element are formed on a common substrate by a common fabrication process and at least one parameter varies between the portion of the VLSOA and the portion of the optical element.

2. The integrated optical device of claim 1 wherein:

the portion of the VLSOA and the portion of the optical element have different transition energies; and

the difference in transition energies between the portion of the VLSOA and the portion of the optical element is a result of the selective area epitaxy.

3. The integrated optical device of claim 1 wherein:

the portion of the VLSOA and the portion of the optical element have different transition energies; and

the difference in transition energies between the portion of the VLSOA and the portion of the optical element is a result of impurity induced disordering.

4. The integrated optical device of claim 1 wherein:

the portion of the VLSOA and the portion of the optical element have different transition energies; and

the difference in transition energies between the portion of the VLSOA and the portion of the optical element is a result of stress-induced disordering.

5. The integrated optical device of claim 1 wherein the optical element includes a passive optical waveguide.

6. The integrated optical device of claim 5 wherein:

the passive optical waveguide includes a core; and

the core and the active region are formed on the common substrate by the common fabrication process but have different transition energies.

7. The integrated optical device of claim 6 wherein the difference in transition energies between the core and the active region is a result of selective area epitaxy.

8. The integrated optical device of claim 6 wherein the difference in transition energies between the core and the active region is a result of impurity induced disordering.

9. The integrated optical device of claim 6 wherein the difference in transition energies between the core and the active region is a result of stress-induced disordering.

10. The integrated optical device of claim 1 wherein the optical element includes an active optical device.

11. The integrated optical device of claim 10 wherein:

the active optical device includes a second semiconductor active region; and

the second semiconductor active region and the semiconductor active region of the VLSOA are formed on the common substrate by the common fabrication process but have different transition energies.

12. The integrated optical device of claim 11 wherein the difference in transition energies between the two semiconductor active regions is a result of selective area epitaxy.

13. The integrated optical device of claim 11 wherein the difference in transition energies between the two semiconductor active regions is a result of impurity induced disordering.

14. The integrated optical device of claim 11 wherein the difference in transition energies between the two semiconductor active regions is a result of stress-induced disordering.

15. The integrated optical device of claim 1 wherein:

the optical element includes an unguided transparent region positioned to optically couple the semiconductor active region with the unguided transparent region; and

the unguided transparent region and the semiconductor active region are formed on the common substrate by the common fabrication process.

16. An integrated optical device comprising:

a vertically lasing semiconductor optical amplifier (VLSOA) comprising:

an amplifier input;

an amplifier output;

a semiconductor active region;

an amplifying path connecting the amplifier input to the amplifier output and traversing the semiconductor active region; and

a vertical laser cavity including the semiconductor active region; and

an optical element, wherein a portion of the VLSOA and a portion of the optical element are formed on a common substrate by separate fabrication processes.

17. The integrated optical device of claim 16 wherein the portion of the VLSOA and the portion of the optical element are formed by etch and fill.

18. The integrated optical device of claim 16 wherein:

the optical element comprises a passive optical waveguide including a core, the passive optical waveguide positioned to optically couple the passive optical waveguide with the semiconductor active region; and

the semiconductor active region and the core are formed on the common substrate by the separate fabrication processes.

19. The integrated optical device of claim 16 wherein:

the optical element includes an active optical element having a second semiconductor active region positioned to optically couple the semiconductor active region of the VLSOA with the second semiconductor active region of the active optical element; and

the semiconductor active region of the VLSOA and the second semiconductor active region are formed on the common substrate by the separate fabrication processes.

20. An integrated optical device comprising:

a vertically lasing semiconductor optical amplifier (VLSOA) comprising:

an amplifier input;

an amplifier output;

a semiconductor active region;

an amplifying path connecting the amplifier input to the amplifier output and traversing the semiconductor active region; and

a vertical laser cavity including the semiconductor active region; and

an optical element, wherein the VLSOA and the optical element are formed on separate substrates by separate fabrication processes and integrated onto a common substrate.

21. The integrated optical device of claim 20 wherein the optical element includes a passive optical waveguide positioned to optically couple the passive optical waveguide with the semiconductor active region.

22. The integrated optical device of claim 20 wherein the optical element includes an active optical element having a second semiconductor active region positioned to optically couple the semiconductor active region of the VLSOA with the second semiconductor active region of the active optical element.

23. A method for making an integrated optical device comprising:

forming a vertically lasing semiconductor optical amplifier (VLSOA) on a substrate; and

forming an optical element on the substrate.

24. The method of claim 23 wherein:

the steps of forming a VLSOA and forming an optical element comprise using a common fabrication process; and

at least one parameter varies between the VLSOA and the optical element.

25. The method of claim 24 wherein the step of using a common fabrication process comprises:

placing a selective area epitaxy mask over selected areas of the substrate; and

depositing material on the masked substrate, whereby the selective area epitaxy mask results in a difference between a transition energy of the material deposited on a first unmasked area of the substrate and a transition energy of the material deposited on a second unmasked area of the substrate, the VLSOA comprising the material deposited on the first unmasked area of the substrate and the optical element comprising the material deposited on the second unmasked area of the substrate.

26. The method of claim 25 wherein the selective area epitaxy mask results in a difference between a composition of the material deposited on the first unmasked area of the substrate and a composition of the material deposited on the second unmasked area of the substrate.

27. The method of claim 24 wherein the step of using a common fabrication process comprises:

placing an impurity induced disordering mask over selected areas of the substrate; and

bombarding the masked substrate with impurities, whereby the impurity induced disordering mask results in a difference between a transition energy of the material underlying a masked area of the substrate and a transition energy of the material underlying an unmasked area of the substrate, the VLSOA comprising the material underlying the masked area of the substrate and the optical element comprising the material underlying the unmasked area of the substrate.

28. The method of claim 24 wherein the step of using a common fabrication process comprises:

placing an impurity induced disordering mask over selected areas of the substrate; and

bombarding the masked substrate with impurities, whereby the impurity induced disordering mask results in a difference between a transition energy of the material underlying a masked area of the substrate and a transition energy of the material underlying an unmasked area of the substrate, the VLSOA comprising the material underlying the unmasked area of the substrate and the optical element comprising the material underlying the masked area of the substrate.

29. The method of claim 24 wherein the step of using a common fabrication process comprises:

using stress-induced disordering to cause a difference between a transition energy of a portion of the VLSOA and a portion of the optical element.

30. The method of claim 23 wherein:

the step of forming a VLSOA on the substrate comprises depositing a first material on the substrate; and

the step of forming an optical element on the substrate comprises:

removing the first material from selected areas of the substrate; and

depositing a second material on the selected areas.

31. The method of claim 23 wherein:

the step of forming an optical element on the substrate comprises depositing a first material on the substrate; and

the step of forming a VLSOA on the substrate comprises:

removing the first material from selected areas of the substrate; and

depositing a second material on the selected areas.

32. A method for making an integrated optical device comprising:

forming a vertically lasing semiconductor optical amplifier (VLSOA) on a first substrate;

forming an optical element on a second substrate; and

integrating the VLSOA and the optical element onto a common substrate.

33. The method of claim 32 wherein the step of integrating the VLSOA and the optical element onto a common substrate comprises one step selected from the group consisting of:

integrating the VLSOA onto the second substrate; and

integrating the optical element onto the first substrate.

34. The method of claim 33 wherein:

the step of forming an optical element on a second substrate comprises forming a passive optical waveguide on the second substrate; and

the step of integrating the VLSOA and the optical element onto a common substrate comprises:

generating in the second substrate a depression for the VLSOA;

positioning the VLSOA within the depression to optically couple the VLSOA to the transparent optical waveguide; and

fixing the VLSOA within the depression.